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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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In the Matter of	)	
	)	
Allocation of Spectrum Below	)	ET Docket No. 94-32
5 GHz Transferred from	)	
Federal Government Use	)	

To: The Commission

REPLY COMMENTS OF APPLE COMPUTER, INC.

Apple Computer, Inc. ("Apple") hereby submits its reply comments in response to the Notice of Proposed Rulemaking ("NPRM") in the above-referenced proceeding. In particular, these comments address the urgent need for the Commission promptly to allocate appropriate spectrum for unlicensed asynchronous (*i.e.*, data) PCS products, including nomadic Data-PCS devices.

In finalizing its PCS spectrum allocation, the Commission reduced the allocation for unlicensed PCS in order to accommodate the requirements of licensed PCS providers and MSS system operators. The Commission recognized, however, that additional spectrum would be required for unlicensed PCS, and stated its commitment to making that spectrum available expeditiously. The Commission reiterated that commitment in the instant NPRM.[1]

The Commission's commitment can be fulfilled, and the prompt development of Data-PCS can be achieved, by allocating the 2390-2400 MHz band to unlicensed asynchronous (or data) PCS. In addition, allocating this band to unlicensed Data-PCS will better serve the public interest than the other allocations suggested by other parties commenting in this proceeding. Finally, Apple supports retaining the current allocation of the 2402-2417 MHz band, rather than introducing new licensed services into the band.

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[1] See NPRM at nn. 27-28.

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List A B C D E

I. THE COMMISSION SHOULD ALLOCATE THE 2390-2400 MHZ BAND FOR UNLICENSED DATA-PCS AND SHOULD REJECT COMPETING CLAIMS FOR THIS SPECTRUM.

A. The Comments Broadly Support This Allocation.

In its comments, Apple discussed the four central reasons for allocating the 2390-2400 MHz band to unlicensed Data-PCS:

- As the Commission previously has recognized and the record in its PCS proceeding demonstrates, Data-PCS represents an important new technology that will benefit users of computing and communications technologies and will enhance American competitiveness, productivity, and education;
- The 2390-2400 MHz band is uniquely suited to meet the essential requirement of Data-PCS: that the spectrum be capable of being made available nationwide in the very near term;
- The 2390-2400 MHz band is the only available spectrum that meets this requirement and, therefore, that will permit the prompt deployment of Data-PCS; and
- Data-PCS will be compatible with the existing uses of the band.

Many of the commenting parties, particularly those in the information industries, reiterated the potential benefits of Data-PCS and the importance of allocating the 2390-2400 MHz band to this service. Support came from a range of businesses, associations, and individuals, including AT&T, Mr. Mike Cheponis, Compaq, Digital Ocean, Microsoft, Standard Micro Systems, Tetherless Access, and the Wireless Cable Association. In addition, the Information Technology Information Council (ITI, formerly CBEMA), a leading trade organization in the information industry, has supported this allocation in an *ex parte* communication to the Commission.[2]

The Software Publishers Association ("SPA"), the principal trade association of the personal computer software industry, presented perhaps the most powerful and realistic description of the numerous benefits that unlicensed Data-PCS products, especially nomadic Data-PCS products, will create. SPA

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[2] See letter to Chairman Reed Hundt from Rhett B. Dawson, President, ITI, dated December 23, 1994.

highlighted the tension between the two dominant developments in computing technology — networking and mobility — and discussed how wireless computing would lead to countless consumer benefits and engender a new generation of microcomputing products and services. SPA also appended a "white paper" entitled "Wireless Computing — Another Step in the Evolution of Educational Technology," which discusses the benefits wireless computing could bring to America's classrooms.

B. Data-PCS Would Be Compatible with Existing Uses of the 2390-2400 MHz Band.

Of all of the suggested uses to which the 2390-2400 MHz band could be put, Data-PCS would be the most compatible with existing uses of the band. As Apple noted in its comments, the technical rules governing Data-PCS devices would be derived from the existing rules for unlicensed asynchronous devices operating in the 1910-1920 MHz unlicensed PCS band.[3] The two groups currently affected by operations in the 2390-2400 MHz band — radio astronomy users and amateur users — would find the relatively low maximum power levels specified in those rules to be benign.

Radio astronomy users, in particular, require careful treatment.[4] Low-power Data-PCS transmitters would minimize the threat of high power transmitters on adjacent frequencies and from spurious emissions appearing within the frequencies of interest, because these devices are constrained both in their in-band and out-of-band emissions.[5]

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[3] The "etiquette"-based rules adopted in the PCS proceeding and reflected in Parts 15.300 *et seq.* of the FCC's rules should be modified to encompass operation within the 2390-2400 MHz band under the constraints of §15.247, with certain obvious differences, such as maximum power levels, to be reconciled through industry recommendation. In this fashion, those desiring to use spread-spectrum modulation technologies in the 2390-2400 band would be allowed to do so, but no one would be required to do so.

[4] See Comments of National Astronomy and Ionosphere Center, Arecibo Observatory, filed on behalf of Cornell University; Comments of the National Academy of Sciences' Committee on Radio Frequencies.

[5] See 47 C.F.R. § 15.321 (d) (requiring that emissions be attenuated below a reference power of 112 milliwatts 30 dB between the channel edges and 1.25 MHz above or below the channel, 50 dB between 1.25 and 2.5 MHz above or below the channel, and 60 dB at 2.5 MHz or greater above or below the channel); see also 47 C.F.R. § 15.319(c), (d) and (e). Under the rules, peak transmit power is limited to 100 microwatts multiplied by the square root of the emission bandwidth in hertz. For example, a 100 kHz data signal would be permitted 32 mW, a 1 MHz signal 100 mW, and a 10 MHz signal 316 mW output. In addition to these existing restrictions, Apple would be willing to work with

Similarly, low powered unlicensed Data-PCS devices would be most compatible with ham radio operators. The ham operators have made clear that, if they must share their frequencies, it is vital that the Commission assign their band to a user that is compatible — both technically and in terms of priority of use — with ham operators.[6] This is in the interest not only of the hams themselves but of the public at large. Amateur radio operators have long served an important public role, for example, by providing an alternative communication path during major storms, earthquakes and other disasters. Yet the other proposed uses for the 2390-2400 MHz band either are clearly incompatible with ham use,[7] appear unlikely to be compatible with ham use, or have failed to address the extent to which they could share spectrum successfully with ham operators.

C. The Commission Should Reject Other Proposed Uses for the 2390-2400 MHz Band.

1. Wireless Local Loop Services.

Several telephone companies suggested that the Commission should allocate the 2390-2400 MHz band, together with the 2300-2310 MHz band, for wireless local loop services. In essence, these companies ask the Commission to

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radio astronomy users to determine whether additional protections may be appropriate in the immediate proximity of the Arecibo Observatory, notwithstanding the very low power and restricted emissions of Data-PCS devices.

[6] See, e.g. Comments of the American Radio Relay League, Incorporated ("AARL") at 18 n.21 ("The League is not averse to compatible sharing partners, provided that the allocation status of amateurs is co-primary with the new user, and that no assignments be made without showing of advance coordination with the Amateur service"); see also Comments of A. Frank Adamson.

[7] See, e.g., discussion of wireless local loop services, infra. Any allocation that would take the 2390-2400 MHz band away from the hams would exacerbate an already difficult situation for these users. As ARRL stated in its comments, "The Amateur Service has had a number of its allocations reduced or eliminated in recent years, and it was the specific intention of Congress that amateur uses in shared government bands not suffer from the reallocation process ordered by the Reconciliation Act.... The Amateur service has, in the past ten years, seen the deletion of the amateur allocation at 2310-2390 MHz, a loss of fully 80 MHz of spectrum.... It has also seen the reallocation of 220-222 MHz, 420 -430 MHz in certain areas of the country , and currently is being threatened with a de facto loss of utility of the 902-928 MHz band, through the imprudent addition of incompatible uses there. The same is true of the 449 MHz band is certain areas. The constant winnowing of amateur VHF and UHF allocations in recent years has resulted in a steady migration of specialized amateur uses, to the bands above 928 MHz." ARRL Comments at 23.

grant existing wireline telephone companies exclusive rights to 20 MHz. This request should be rejected by the Commission.

First, allocating the 2390-2400 and 2300-2310 MHz bands for wireless local loop service would conflict directly with the Commission's goal of increasing competition in local telephone markets. Not surprisingly, the incumbent telephone companies seek an immediate allocation that would be available exclusively to existing wireline carriers.[8] Because the entire 20 MHz would be allocated in a single block[9] and, in most cases, would not be auctioned,[10] existing carriers would be able to "lock in" 20 MHz of free spectrum and deny future competitors access to what — according to the incumbent telephone companies themselves — is a valuable, and in some cases essential, resource.

Second, the proposed allocation may be largely duplicative of, and inconsistent with, the recently-concluded PCS allocation. While wireless local loop proponents state that this service would provide primarily fixed services and therefore is distinct from the PCS allocation,[11] they admit that the band would be used for some mobile applications.[12] Indeed, the proponents generally did not recommend that the Commission limit the allocation to fixed services.[13] Telephone carriers would thus, at a minimum, be able to provide at least some of the services envisioned for PCS systems (such as cordless telephone services and limited-range "neighborhood" mobile telephone services, both of which were described as important potential PCS services in the FCC's PCS Task Force

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8 E.g., Bell Atlantic Comments at n.4 ("[a]ny entity authorized to provide local loop services in a particular jurisdiction should be eligible to obtain licenses to use the spectrum addressed in these Comments."); Comments of TDS Telecommunications Corp. at 4 (bands would be available for licensing to LECs in their state-recognized local exchange service areas).

9 E.g., Comments of Rochester Telephone at 3, Comments of SWBT at 9.

10 Under the Budget Act, spectrum may be auctioned only if mutually exclusive applications have been filed. As a result, if only existing local exchange carriers operating within their service areas are eligible for licenses in these bands, auctions would be possible only for licenses to serve the relatively few service areas in which local exchange competition has been authorized.

11 E.g., Comments of SWBT at 8-9.

12 E.g., Comments of SWBT at 2.

13 But see Comments of TDS Telecommunications Corp. at 6, Comments of United States Telephone Association at n.7 (a restriction on providing mobile services using wireless local loop frequencies "may" be appropriate).

hearings).[14] The overlap between wireless local loop and PCS services would be significantly greater if wireless local loop systems were used to provide a wide range of mobile services.[15]

Such an overlapping allocation not only is an inefficient use of spectrum, it also could threaten the ongoing PCS auctions, the development of PCS systems, and the Commission's spectrum cap rules. Wireless local loop spectrum generally would not be auctioned, and licensees in these bands would not be subject to the stringent PCS build-out requirements. As a result, these licensees would have a significant advantage over PCS providers and their existence could dampen PCS development. Indeed, even the promise of free, PCS-like spectrum could undermine the PCS license auctions.

Even if a wireless local loop allocation did not raise the serious policy concerns discussed above, such an allocation would not represent the best and most valued use for the 2390-2400 MHz band. Proponents of a wireless local loop allocation describe several niche services that would be provided via this spectrum: increasing telephone penetration in rural areas, meeting seasonal demand in summer resort areas, providing additional lines to certain existing customers, and replacing aging plant in certain high-cost areas. Yet they seek a 20 MHz nationwide allocation, in addition to the existing Basic Exchange Telecommunications Radio Service (BETRS) allocation, and would deny all other users (including amateur users and Data-PCS users) access to this band.[16]

In light of the relatively limited uses described by proponents of a wireless local loop allocation, devoting 20 MHz, nationwide, exclusively to this service would not serve the public interest.[17] The goals cited by the proponents could

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14 See, e.g., Comments of Taridan Telecommunications Ltd. (suggesting that wireless local loop systems be permitted to provide "neighborhood mobility").

15 If, on the other hand, wireless local loop services would indeed be fixed services, they could be accommodated at higher frequencies. See Comments of Avant-Garde Telecommunications, Inc. (wireless local loop services could be provided in the 38 GHz band). The frequencies identified by Avant-Garde are near the allocations under Commission investigation in ET Docket 94-124.

16 E.g., Comments of SWBT at 7.

17 For example, SWBT estimates that wireless local loop applications would provide approximately three percent geographic coverage per year. Comments of SWBT at 8. Using this estimate, even a decade after licenses for this service were granted, the spectrum would lie fallow in more than two-thirds of the country. US West's suggestion that the Commission permit licensees to lease excess spectrum to third parties would not

better be met in other ways. If, on the other hand, wireless local loop services will provide a broad range of important fixed and mobile services, then the anti-competitive effects of such an allocation on potential competitive local telephone carriers and on PCS providers are profound. In either case, the Commission should reject this proposed allocation.

2. Private Systems.

Several of the commenting parties suggested that the FCC allocate the 2390-2400 MHz band to private systems, such as those described in the COPE petition for "private PCS."

While Apple agrees that an allocation for these types of services may have merit, the 2390-2400 MHz band would not meet their requirements. Although the proponents of a private allocation provided fairly generalized descriptions of the envisioned service and few estimates of the spectrum required to support those services, it is clear that most desire an allocation that would support very wide band applications (such as full motion video) throughout large geographic areas. For example, the Los Angeles County Sheriff suggested that two to four 6 MHz wide video channels would be needed.[18] Motorola suggested that 75 MHz would be required to meet COPE's needs.[19] A single 10 MHz channel would clearly be inadequate to meet these requirements.[20]

While this band could conceivably be combined with other bands, forcing operators to design systems today without a complete allocation is problematic. Moreover, in such a scenario individual networks would be forced to operate on multiple bands, which would increase the technical and administrative

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serve the public interest if, as proposed by SWBT and others, local exchange telephone companies had exclusive rights to obtain licenses in these bands.

18 Comments of the Los Angeles County Sheriff's Department at 4; see also Comments of APCO (users require broadband communications networks to transmit, among other things, live full motion video).

19 Motorola Comments at 9.

20 Motorola also states that this band suffers from noise problems that will raise infrastructure costs and states that, "[f]rom a pure spectrum engineering standpoint, other bands that are the subject of the NTIA transfer could be preferable for private systems." Motorola Comments at 7, 9. Although it concludes that, notwithstanding these problems, the band could be used for private services, it conditions its conclusions on the Commission pairing this band with the 2300-2310 MHz band and allocating additional spectrum in the future.

complexity and cost of systems, and could create interoperability problems. For these reasons, Apple believes that private users could better be accommodated in another, larger band — either a band to be reallocated by NTIA in the next several years, in unallocated emerging technologies spectrum , or elsewhere.

For Data-PCS, the 2390-2400 MHz band is the only viable solution in view; for private users, it is at best a partial, and non-unique, accommodation. Indeed, many of the users requesting an allocation for private systems did not specifically request an allocation of the 2390-2400 MHz band. As a result, the public interest will best be served if the Commission allocates this band to the users who most immediately and uniquely require it — Data-PCS users and current amateur and radio astronomy users — while seeking an alternative acceptable allocation for private systems.

3. Other.

The other uses suggested for the band — including in-flight services, additional PCS spectrum, or general fixed and mobile allocations — also would not serve best the public interest.

In-flight services would (at a minimum) substantially reduce the ability of ham radio operators to use the 2390-2400 MHz band. While some proponents of these services assert that they could share spectrum with ham operators, Apple believes that the conditions under which ham operators would be required to operate (as described in comments filed by proponents of an in-flight allocation) would be unworkable. In addition, in-flight services — which would merely augment existing technologies, such as video recorders, and which would be limited to ground-to-air transmissions and, therefore, could provide only a finite range of entertainment services — would not promise the substantial public interest benefits of Data-PCS. Finally, the fact that some entities may have invested in equipment for use under an existing experimental license should not itself form the basis for a Commission spectrum allocation decision.

With respect to PCS, the Commission has recently allocated a very large block of frequencies to PCS, and it would be inadvisable at this point to set aside additional spectrum for this service. In particular, it would not serve the public interest to permit PCS licensees to obtain new spectrum merely to avoid the cost

and inconvenience of moving incumbent microwave stations out of the 2 GHz band, as Pacific Telesis suggested.[21]

Finally, a generalized fixed/mobile allocation is inadvisable for the reasons discussed in Apple's comments in this proceeding and by many other commenting parties. As virtually all of the parties addressing this proposal stated, such an allocation suffers from a wide range of legal and policy flaws: it is unlikely to place the spectrum at its best and most valued use; it may create a patchwork of non-complimentary services that do not support interoperability, roaming, and other attributes desired by users; it ignores the Commission's obligation to determine spectrum allocations in the public interest; and it could result in difficult technical problems that would be costly and time-consuming to resolve. Moreover, using auctions to assign such licenses would violate the requirements of the Budget Act that competitive bidding only be used under certain clearly defined conditions, that the FCC use available tools to avoid mutual exclusivity, and that auctions not be used to determine spectrum allocations. At a minimum, such an allocation would likely unleash a barrage of legal challenges and power struggles that would keep the Commission staff occupied, and the spectrum unutilized, for the foreseeable future.

II. THE COMMISSION SHOULD NOT AUCTION THE 2402-2417 MHZ BAND OR LICENSE ANY NEW SERVICES IN THAT BAND.

The comments provided a comprehensive overview of the important Part 15 applications relying (or expecting to rely) on the 2.4 GHz ISM band, as well as the harm that would be caused to manufacturers and users if the Commission were to license services in this band.[22] Comments supporting continued unlicensed operation in the band were filed not only by manufacturers of Part 15

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21 See Comments of Pacific Telesis at 2.

22 See Comments of 3Com Corporation; Comments of Compaq Computer Corporation; Comments of Cylink Corporation; Comments of Norand Corporation; Comments of Microsoft Corporation; Comments of the Software Publishers Association; Comments of Symbol Technologies, Inc.; Comments of Xircom; see also Comments of Advanced Micro Devices, Inc. ("AMD"); Comments of AT&T Corporation; Comments of Electronic Industry Association of the Consumer Electronics Group ("EIA/CEG"); Comments of IEEE 802; Comments of Industrial Telecommunications Association, Inc. ("ITA"); Comments of International Business Machines Corporation ("IBM"); Comments of Metricom, Inc.; Comments of Motorola, Inc.; Comments of Rockwell International Corporation; Comments of Telecommunications Industry Association; Comments of Tetherless Access Ltd.; Comments of Western Multiplex Corporation; Comments of Wireless Information Network Forum, Inc. ("WINForum").

devices, but also by parties (such as UTC and API) that currently utilize these devices to meet their internal communications needs. Apple will not repeat these comments, except to reiterate its strong support for retaining the existing allocation of the 2.4 GHz ISM band.

CONCLUSION

For the reasons stated above, Apple respectfully requests that the Commission take the actions discussed herein and in its comments filed in this proceeding.

Respectfully submitted,

APPLE COMPUTER, INC.

James F. Lovette
One Infinite Loop, MS: 301-4J
Cupertino, California 95014
(408) 974-1418

OF COUNSEL:

Henry Goldberg
GOLDBERG, GODLES, WIENER & WRIGHT
1229 Nineteenth Street, N.W.
Washington, D.C. 20036
(202) 429-4900

January 6, 1995

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing Reply Comments of Apple Computer, Inc. was sent by first-class mail, postage prepaid, this 6th day of January, 1995, to each of the following:

Mr. Louis J. Piazza
Windata, Inc.
543 Great Road
Littleton, Massachusetts 01460

Mr. Burton G. Tregub
Cylink Corporation
910 Hermosa Court
Sunnyvale, California 94087

Mr. Randall H. Holliday
Xircom
2300 Corporate Center Drive
Thousand Oaks, California 91320

Mr. Dewayne Hendricks
Tetherless Access Ltd.
2468 Embarcadero Way
Palo Alto, California 94303

Henrietta Wright, Esq.
W. Kenneth Ferree, Esq.
Goldberg, Godles, Wiener & Wright
1229 Nineteenth Street, N.W.
Washington, D.C. 20036
Counsel for Part 15 Coalition

Mr. David R. Couch
28652 Nuevo Valley Drive
Nuevo, California 92567

Mr. Bruce Perens
Northern California Packet Association
c/o Pixar
1001 W. Cutting #200
Richmond, California 94804

Mr. Brian Robinson
782 Chateau Lane
Plano, Texas 75023

Mr. Michael V. Collis
Amateur Television Network
P.O. Box 1594
Crestline, California 92325

Mr. Victor Tawil
Association for Maximum Service Television, Inc.
1776 Massachusetts Avenue, N.W.
Suite 300
Washington, D.C. 20036

Gregory M. Schmidt, Esq.
Ronald J. Krotoszynski, Jr., Esq.
Covington & Burling
1201 Pennsylvania Avenue, N.W.
P.O. Box 7566
Washington, D.C. 20044
Counsel for Association for Maximum Service Television, Inc.

Mr. Sam Antar
Capital Cities/ABC Inc.
77 West 66th Street
16th Floor
New York, New York 10023

Mark W. Johnson, Esq.
CBS Inc.
1634 I Street, N.W.
Washington, D.C. 20006

Ms. Molly Pauker
Fox, Inc. and Fox Television Stations, Inc.
5151 Wisconsin Avenue, N.W.
Washington, D.C. 20016

Mr. Henry L. Baumann
Mr. Barry D. Umansky
Ms. Kelly T. Williams
NAB Science and Technology
National Association of Broadcasters
1771 N Street, N.W.
Washington, D.C. 20036

Mr. Howard Monderer
National Broadcasting Company, Inc.
1229 Pennsylvania Avenue, N.W.
11th Floor
Washington, D.C. 20004

Mr. Howard N. Miller
Public Broadcasting Service
1320 Braddock Place
Alexandria, Virginia 22314

J. Laurent Scharff, Esq.
Reed, Smith, Shaw & McClay
1200 18th Street, N.W.
Washington, D.C. 20036
Counsel for Radio-Television News Directors Association

Ms. Marilyn Mohrman-Gillis
Association of America's Public Television Stations
1350 Connecticut Avenue
Suite 200
Washington, D.C. 20036

Robert M. Gurss, Esq.
Ramsey L. Woodworth, Esq.
Wilkes, Artis, Hedrick & Lane, Chartered
1666 K Street, N.W., #1100
Washington, D.C. 20006
Counsel for Association of Public-Safety Communications Officials-International, Inc. and Los Angeles County Sheriff's Department

Thomas J. Keller, Esq.
Michael S. Wroblewski, Esq.
Verner, Liipfert, Bernhard, McPherson and Hand, Chartered
901 15th Street, N.W.
Suite 700
Washington, D.C. 20005
Counsel for The Association of American Railroads

Christopher D. Imlay, Esq.
Booth, Freret & Imlay
1233 20th Street, N.W.
Suite 204
Washington, D.C. 20036
Counsel for The American Radio Relay League, Incorporated

Stephen L. Goodman, Esq.
Melanie Haratunian, Esq.
Halprin, Temple & Goodman
1100 New York Avenue, N.W.
Suite 650
Washington, D.C. 20005
Counsel for Avant-Garde Telecommunications, Inc.

Thomas J. Dougherty, Jr., Esq.
Gardner, Carton & Douglas
1301 K Street, N.W.
Suite 900 East Tower
Washington, D.C. 20005
Counsel for American Telecasting, Inc.

Robert J. Miller, Esq.
Jeffrey D. Jacobs, Esq.
Gardere & Wynne, L.L.P.
1601 Elm Street, Suite 3000
Dallas, Texas 75201
Counsel for Alcatel Network Systems, Inc.

Mr. Mike Cheponis
618 Enos Court
Santa Clara, California 95051-6207

Benjamin J. Griffin, Esq.
Reed, Smith, Shaw & McClay
1200 18th Street, N.W.
Washington, D.C. 20036
Counsel for Home Box Office, a Division of Time Warner Entertainment Company, L.P.

Mr. James H. Baker
Forest Industries Telecommunications
871 Country Club Road, Suite A
Eugene, Oregon 97401-2200

Mr. Mark J. Golden
Personal Communications Industry Association
1019 19th Street, N.W.
Suite 1100
Washington, D.C. 20036

David E. Weisman, Esq.
Alan S. Tilles, Esq.
Meyer, Faller, Weisman and Rosenberg, P.C.
4400 Jenifer Street, N.W.
Suite 380
Washington, D.C. 20015
Of Counsel for Personal Communications Industry Association

Mr. Jim Porep
Pegasus Communications Inc.
1825 Ponderosa
Corona, California 91720

Mr. Carl Guastaferro
Northern Amateur Relay Council of California Inc.
P.O. Box 60531
Sunnyvale, California 94088-0531

Mr. Arthur C. McBride
Palomar Amateur Radio Club Inc.
P.O. Box 73
Vista, California 92085-0073

James P. Tuthill, Esq.
Betsy Stover Granger, Esq.
Pacific Bell Mobile Services
140 New Montgomery Street, Room 1525
San Francisco, California 94105

James L. Wurtz, Esq.
Pacific Bell Mobile Services
1275 Pennsylvania Avenue, N.W.
Washington, D.C. 20004

Mr. Robert S. Bennett, Ph.D.
1006 Green Acre Road
Towson, Maryland 21286

Mr. William A. Tynan
Radio Amateur Satellite Corporation
P.O. Box 27
Washington, D.C. 20044

Robert J. Rini, Esq.
Rini & Coran, P.C.
Dupont Circle Building
1350 Connecticut Avenue, N.W.
Suite 900
Washington, D.C. 20036
Counsel for Wireless Holdings, Inc.

Paul J. Sinderbrand, Esq.
Sinderbrand & Alexander
888 Sixteenth Street, N.W.
Suite 610
Washington, D.C. 20006-4103
Counsel for Wireless Cable Association International, Inc.

Mr. William A. Burns
247 Rebel Road
Ridgecrest, California 93555

E.R. Angle
Western States VHF-Microwave Society
P.O. Box 35
Lomita, California 90717-0035

Mr. Bradley Herrin
Standard Microsystems Corporation
6 Hughes
Irvine, California 92718-2021

L. Stephen Bell
1702 E. Camino Cielo
Tucson, Arizona 85718

William R. Richardson, Jr., Esq.
Lynn R. Charytan, Esq.
Wilmer, Cutler & Pickering
2445 M Street, N.W.
Washington, D.C. 20037
Counsel for International Business Machines Corporation

Ms. Shiela J. McCartney
International Business Machines Corporation
500 Columbus Avenue
Thornwood, New York 10594

Mr. John M. Osepchuk
International Microwave Power Institute
10210 Leatherleaf Court
Manassas, Virginia 22111

Ms. Leslie S. Levine
Fusion Systems Corporation
7600 Standish Place
Rockville, Maryland 20855-2798

Mr. Kent Kipling
Fusion Lighting, Inc.
15700 Crabbs Branch Way
Rockville, Maryland 20855

Frank R. Jazzo, Esq.
Kathryn A. Kleiman, Esq.
Paul J. Feldman, Esq.
Fletcher, Heald & Hildreth, P.L.C.
1300 North 17th Street, 11th Floor
Rosslyn, Virginia 22209
Counsel for 3Com Corporation, Cornell University and National Research Council for the National Academy of Sciences

R. Michael Senkowski, Esq.
Jeffrey S. Linder, Esq.
Wiley, Rein & Fielding
1776 K Street, N.W.
Washington, D.C. 20006
Counsel for Advanced Micro Devices, Inc.

Catherine Wang, Esq.
Swidler & Berlin, Chartered
3000 K Street, N.W.
Suite 300
Washington, D.C. 20037
Counsel for Andrew Corporation

Mark C. Rosenblum, Esq.
Kathleen F. Carroll, Esq.
Ernest A. Gleit, Esq.
AT&T Corp.
Room 3261B3
295 North Maple Avenue
Basking Ridge, New Jersey 07920

Mr. David M. Stevenson
Cincinnati Microwave, Inc.
One Microwave Plaza
Cincinnati, Ohio 45249

Joseph A. Tasker, Jr., Esq.
Compaq Computer Corporation
1300 I Street, N.W., 490 East
Washington, D.C. 20005

Ian D. Volner, Esq.
William Coston, Esq.
Venable
1201 New York Avenue, N.W.
Suite 1000
Washington, D.C. 20005
Of Counsel for Compaq Computer Corporation

Ms. Barbara N. McLennan
Mr. George A. Hanover
Mr. Joe P. Peck
Consumer Electronics Group
Electronic Industries Association
2001 Pennsylvania Avenue, N.W.
Washington, D.C. 20006

Joseph P. Markoski, Esq.
Stephen R. Bell, Esq.
Jeffrey A. Campbell, Esq.
Squire, Sanders & Dempsey
1201 Pennsylvania Avenue, N.W.
Post Office Box 407
Washington, D.C. 20044
Of Counsel for Consumer Electronics Group, Electronic Industries Association
Counsel for Norand Corporation

Mr. Jeffery J. Alholm
Digital Ocean, Inc.
11206 Thompson Avenue
Lenexa, Kansas 66219-2303

Mr. Michael A. Fischer
Digital Ocean, Inc.
4242-3 Medical Drive
San Antonio, Texas 78229-5642

Mr. Donald C. Loughry
Hewlett-Packard Company
19420 Homestead Road, M/S 43UC
Cupertino, California 95014

Mr. Mark E. Crosby
Frederick J. Day, Esq.
Industrial Telecommunications Association, Inc.
1110 N. Glebe Road
Suite 500
Arlington, Virginia 22201

John T. Scott, III, Esq.
William D. Wallace, Esq.
Crowell & Moring
1001 Pennsylvania Avenue, N.W.
Washington, D.C. 20004-2505
Counsel for Loral/Qualcomm Partnership, L.P.

Ms. Leslie A. Taylor
Leslie Taylor Associations
6800 Carlynn Court
Bethesda, Maryland 20817-4302
Counsel for Loral/Qualcomm Partnership, L.P.

William K. Keane, Esq.
Winston & Strawn
1400 L Street, N.W.
Washington, D.C. 20005-3502
Counsel for Manufacturers Radio Frequency Advisory Committee, Inc.

Henry M. Rivera, Esq.
Rodney L. Joyce, Esq.
Larry S. Solomon, Esq.
Ginsburg, Feldman and Bress, Chtd.
1250 Connecticut Avenue, N.W.
Washington, D.C. 20036
Counsel for Metricom, Inc. and In-Flight Phone Corporation

Mr. William J. Gordon
In-Flight Phone Corporation
1146 19th Street, N.W., Suite 200
Washington, D.C. 20036

Mr. Edward Mitchell
Microsoft Corporation
One Microsoft Way
Redmond, Washington 98052

Mr. Michael D. Kennedy
Mr. Stuart E. Overby
Motorola, Inc.
1350 I Street, N.W.
Washington, D.C. 20005

M. Robin Critchell
Southern California Repeater and Remote Base Association
P.O. Box 5967
Pasadena, California 91117

Peter Tannenwald, Esq.
Mitchell Lazarus, Esq.
Arent, Fox, Kintner, Plotkin & Kahn
1050 Connecticut Avenue, N.W.
Washington, D.C. 20036-5339
Counsel for Symbol Technologies, Inc.

Mr. Raymond A. Martino
Symbol Technologies, Inc.
1101 S. Winchester Boulevard
Suite B-110
San Jose, California 95128

Mr. George M. Kizer
Mr. Jesse Russell
Mr. Eric Schimmel
Telecommunications Industry Association
2500 Wilson Boulevard
Suite 300
Arlington, Virginia 22201

Mr. Graham R. Barnes
Western Multiplex Corporation
300 Harbor Boulevard
Belmont, California 94002

Ms. Nancy A. Bukar
WINForum
1200 19th Street, N.W.
Suite 300
Washington, D.C. 20036

Lawrence W. Katz, Esq.
The Bell Atlantic Telephone Companies
1710 H Street, N.W.
Washington, D.C. 20006

Dvora Wolff Rabino, Esq.
Capital Cities/ABC Inc.
77 West 66th Street
New York, New York 10023

Leonard A. Ceruzzi, Esq.
Continental Airlines
1300 I Street, N.W., Suite 950E
Washington, D.C. 20005

Dr. Willem A. Baan
Cornell University
National Astronomy and Ionosphere Center
Arecibo Observatory
P.O. Box 995
Arecibo, Puerto Rico 00613

Mr. Thomas H. Bugbee
Mr. Bruce Malt
Regulatory Affairs,
Telecommunications Branch
Information Technology Services
County of Los Angeles
Internal Services Department
P.O. Box 2231
Downey, California 90242

Edward R. Wholl, Esq.
William J. Balcerski, Esq.
NYNEX Telephone Companies
120 Bloomingdale Road
White Plains, New York 10605

Lisa M. Zaina, Esq.
The Organization for the Protection and Advancement of Small Telephone Companies
21 Dupont Circle, N.W.
Washington, D.C. 20036

Michael J. Shortley, III, Esq.
Rochester Telephone Corporation
180 South Clinton Avenue
Rochester, New York 14646
Counsel for Frontier Corporation

Mr. Mike Morris
SR Telecom Inc.
8150 Trans-Canada Highway
St. Laurent, Quebec
CANADA H4S 1M5

Wayne V. Black, Esq.
Joseph M. Sandri, Jr., Esq.
Keller and Heckman
1001 G Street, N.W.
Suite 500 West
Washington, D.C. 20001
Of Counsel for American Petroleum Institute and SR Telecom Inc.

Robert M. Lynch, Esq.
Richard C. Hartgrove, Esq.
Anthony K. Conroy, Esq.
Southwestern Bell Telephone Company
One Bell Center, Room 3520
St. Louis, Missouri 63101

Margot Smiley Humphrey, Esq.
Koteen & Naftalin
1150 Connecticut Avenue, N.W.
Washington, D.C. 20036
Counsel for TDS Telecommunications Corp.

Jeffrey S. Bork, Esq.
Laurie J. Bennett, Esq., Of Counsel
U S West Communications, Inc.
1020 19th Street, N.W., Suite 700
Washington, D.C. 20036

Mary McDermott, Esq.
Linda Kent, Esq.
United States Telephone Association
1401 H Street, N.W., Suite 600
Washington, D.C. 20005

Jeffrey L. Sheldon, Esq.
Sean A. Stokes, Esq.
UTC
1140 Connecticut Avenue, N.W.
Suite 1140
Washington, D.C. 20036

Mark Traphagen, Esq.
Mr. Kenneth A. Wasch
Software Publishers Association
1730 M Street, N.W.
Suite 700
Washington, D.C. 20036-4510

Mr. John R. Tuttle
Micron Communications, Inc.
2805 East Columbia Road
Boise, Idaho 83706

Mr. Rhett B. Dawson
Information Industry Council
1250 Eye Street, N.W.
Suite 250
Washington, D.C. 20005

Mr. Michael S. Leonard
American West Airlines
Phoenix Sky Harbor International Airport
4000 E. Sky Harbor Boulevard
Phoenix, Arizona 85034

Mr. David E. Laag
San Bernardino Microwave Society
247 Rebel Road
Ridgecrest, California 93555

Dr. Arthur Frank Adamson, Ph.D.
839 Pine Drive
Felton, California 95018-9103

Dr. Robert L. Riemer
HA-562
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

Ms. Linda C. Sadler
Rockwell International Corporation
1745 Jefferson Davis Highway
Suite 1200
Arlington, Virginia 22202

Caressa D. Bennet, Esq.
Law Offices of Caressa D. Bennet
1831 Ontario Place, N.W.
Suite 200
Washington, D.C. 20009

Mr. Austin H. Lesea
Larus Corporation
1560 Berger Drive
San Jose, California 95112

Mr. Michael J. Drake
Department of Planetary Sciences
Lunar and Planetary Laboratory
University of Arizona
Tucson, Arizona 85721

Laurie A. Gray

/s/ Laurie A. Gray
Laurie A. Gray